

The Horror of Land Mines

*Land mines kill or maim more than 15,000 people each year.
Most victims are innocent civilians. Many are children.
Still, mines are planted by the thousands every day*

by Gino Strada

Finally, the terrible bloodshed in Rwanda had come to an end. Alphonsine and her family were returning to their house when Alphonsine stepped on an unseen mine. At the hospital in Kigali, run by the surgical team of the relief organization EMERGENCY, I and other physicians did what we could to repair the damage. The explosion had smashed Alphonsine's legs and fractured her left forearm. We had to amputate both legs above the knee. Her sister sustained a penetrating brain injury from a metallic fragment; she never regained consciousness and died six hours after surgery. Their father, who had been meters away from the two girls, had only multiple small wounds in his chest.

As a surgeon for EMERGENCY, I have treated many children such as Alphonsine and her sister—victims of a new kind of war. The great majority of modern conflicts are now internal rather than international: they are civil wars, struggles for independence, ethnic and racial “cleansings,” terrorist campaigns. Today armies of irregulars without uniforms routinely fight with devastating weapons in the midst of crowded areas. Many armed groups deliberately mix with the population to avoid identification. Sometimes they actually use civilians as shields. Quite often, targeting and terrorizing large civilian groups are part of an army's primary military strategy.

Accordingly, civilians have increasingly become victims of war. During World War I, they represented only 15 percent of all fatalities, but by the end of World War II the percentage had risen to 65 percent, including Holocaust casualties. In today's hostilities, more than 90 percent of all of those injured are civilians. Numerous research institutes, among them the Stockholm International Peace Research Institute and the International Peace Research Institute in Oslo, and humanitarian organizations involved in victim assistance have confirmed these figures.

One of the most dramatic aspects of this catastrophic change is the ever more widespread use of inhumane weapons

such as antipersonnel mines. They characteristically pose an indiscriminate and persistent threat. Land mines do not distinguish the foot of a combatant from that of a playing child. Land mines do not recognize cease-fires or peace agreements. And once laid, they can maim or kill for many decades after any hostilities have ended. For this reason, the antipersonnel mine has been referred to as “a weapon of mass destruction in slow motion.”

Mine Pollution

Mines have been used in various guises since the beginning of the century, but military philosophy has evolved over the years to make more cunning use of them. They are no longer seen simply as weapons for denying an enemy certain lands, or for channeling an enemy's troop movements, or for protecting key installations. Instead they are now often laid to deprive a local population access to water sources, wood, fuel, pathways and even burial grounds. In many countries, in fact, helicopters, artillery and other remote means have been used to scatter mines randomly over villages or agricultural land as deliberate acts of terrorism against the civilian population.

In technical terms, an antipersonnel

mine (also known as an AP mine) can be defined as a device designed to kill or maim the person who triggers it. (In contrast, antitank mines, usually called ATMs, are specifically designed for blowing up tanks and vehicles. They explode only when compressed by something weighing hundreds of kilograms.) AP mines are generally rather small in diameter, frequently less than 10 centimeters across, and difficult to detect. In some cases, the color and shape of the mine help to camouflage it so that it becomes virtually invisible at a glance.

A land mine is activated when the victim triggers the firing mechanism, usually by applying direct pressure to the mine itself or by putting tension on a trip wire. That action sets off the detonator, which in turn ignites the booster charge, a small amount of high-quality explosive. The detonation of the booster charge detonates the land mine's main charge, completing the explosive chain.

In recent years, mine technology has evolved significantly. The development of plastic mines, as well as those containing a minimum amount of metal,

has made these weapons cheaper, more reliable, more durable and harder to detect and dismantle. In addition, remote deployment systems (such as helicopters) have made it possible to deliver thousands of mines to a broad territory within just a few minutes. Laying mines in this way also makes it impossible to record exactly where they land, so recovering them is all the more difficult.

Unfortunately, land-mine technology is quite simple and its price very low—most weapons cost in the range of \$3 to \$15. As a result, they have been profitably manufactured and sold by a rising number of countries in past years, including many in the developing world. Approximately 50 nations have produced and exported antipersonnel mines, and at least 350 models are currently available, not only to official armies but essentially to all fighting groups and armed factions worldwide.

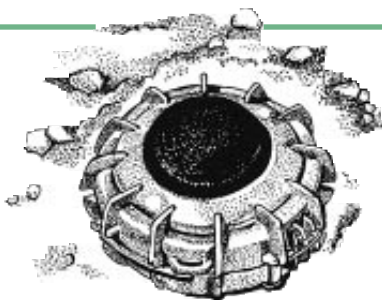
The number of unexploded mines in place around the globe is not known. According to several sources (including the United Nations, the U.S. State Department and various humanitarian

SMALL SB-33 MINE, shown at its actual size below, blends with these stones so well that it becomes virtually invisible. When a person steps on such a blast mine, the resulting explosion typically blows off a foot or leg. Many antipersonnel mines are currently made in colors and shapes that help to camouflage them once laid.



Patterns of Injuries

PATTERN A INJURIES, suffered by the boy below, are most often caused by small blast mines, such as the VS-50 mine shown at the right. These weapons, less than 10 centimeters in diameter, most often amputate a foot or leg, depending on how they are stepped on. Rarely do they produce wounds higher than the knee or on the opposite leg.



agencies), at least 100 million are now scattered across 64 countries. Because neither manufacturers nor users typically keep records, though, these figures very likely underestimate the real situation. Whatever the case, a significant portion of the world undeniably suffers from what might be considered “land-mine pollution.”

The agencies offering victim assistance or operations to clear mines estimate that during the past two decades these weapons have killed or maimed approximately 15,000 people each year. Of these victims, about 80 percent were civilians. In fact, the actual number is probably even higher given that many accidents occur in remote areas without medical facilities and so are not documented. In a mined area, many everyday activities—gathering wood or food, drawing water, farming, playing, tending livestock—become highly risky. I have personally treated 1,950 people injured by mines; of them, 93 percent were civilians, and 29 percent were children younger than the age of 14.

The Damage Mines Inflict

Practically speaking, antipersonnel mines can be divided into two large groups: blast mines and fragmentation mines. Blast mines usually respond to pressure—for example, from a descend-

ing foot on a sensitive plate. The injuries to the body from blast mines are direct consequences of the explosion itself. In contrast, fragmentation mines are usually activated by trip wires. When they explode, a large number of metallic fragments fly outward for a considerable distance. These fragments are either contained inside the mine or result from the rupture of its segmented outer case.

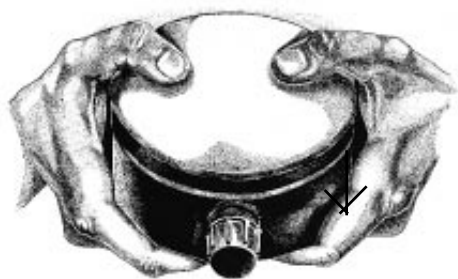
The type of mine, the specifics of its operation, its position on the ground, the position of the victim and the characteristics of the environment at the explosion site all affect the nature and extent of the damage a mine causes. Victims suffer from a broad range of injuries. Nevertheless, four general patterns are recognizable. I apologize if the description I shall offer of those injuries is disturbing to many readers. Yet to grasp how truly awful these weapons are, one must be aware of what they do and how they do it.

Small blast mines, having diameters of less than 10 centimeters, produce a very common pattern of injury that we call Pattern A. Among the most common mines in this group are the Italian scatterable mines TS-50 and SB-33 and the hand-laid VS-50 and VAR-40, the U.S.-made M14, and the Chinese Type 72. Typically, these weapons amputate the foot or leg. In some cases, only part of the foot may be blown off, depending

on how the mine was placed and how it was stepped on. In most cases, the injuries from these types of mines occur below the knee, and no major wounds are present higher on the body or on the opposite leg.

Larger antipersonnel blast mines, such as those in the Russian PMN series, usually cause a different type of injury (Pattern B). This difference arises in part simply from the discrepancy in the size of the weapon. The diameter of the “small” VS-50 is 9.0 centimeters, whereas a PMN is 11.2 centimeters. The shock waves from both mines explode outward at the same high speed, approximately 6,800 meters per second, seven times the speed of a high-velocity bullet. But the cone of the explosion—the volume carrying the explosive force—is much wider for the larger mine. The large mines also contain much more high-quality explosive material. A VS-50, for instance, has 42 grams of RDX-TNT; a PMN-2 carries 150 grams of TNT; and a PMN contains 240 grams.

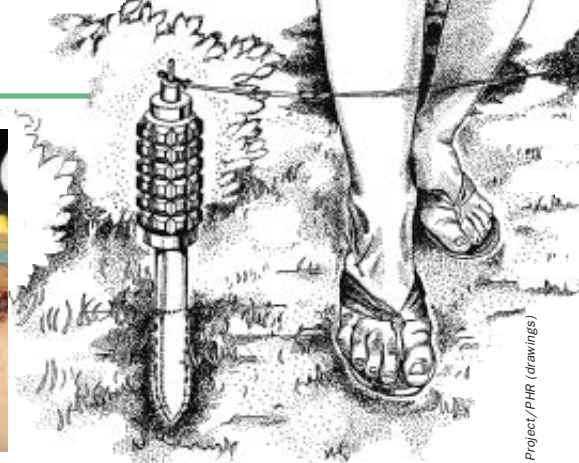
Victims stepping on these large antipersonnel mines invariably suffer a traumatic amputation. Quite often the lower part of the leg is blown off. A piece of the tibia (the large bone in the shin) may protrude from the stump, and the remaining muscles are smashed and pushed upward, giving the injury a grotesque cauliflowerlike appearance.



PATTERN B INJURIES, sustained by some of the children shown at the left at the Red Cross hospital in Kabul, Afghanistan, result from stepping on antipersonnel mines such as the PMN (*above*). These mines are not much larger than small blast mines, but they pack far more explosive material. As a result, they often blow off the lower leg and cause further harm to the thighs, genitals or buttocks.



PATTERN C INJURIES are produced by the PFM-1, the so-called butterfly mine (*left*). These mines explode only after cumulative pressure has been applied to their wings, which help them initially to glide to the ground after being released from a helicopter. Because they are usually being handled when they go off, these mines amputate fingers or hands and damage the face and chest as well. Almost all victims are children, such as the one shown above, who treat the mines as toys.



PATTERN D INJURIES indicate that a person has tripped a fragmentation mine, such as the POMZ-2 "stake" mine above. These mines usually kill anyone who comes into direct contact with them by discharging metallic shards over a wide area.

Occasionally, the lower leg is blown off completely, along with the knee. Large wounds are often sustained in the thigh, the genitals or the buttocks. In many patients the opposite leg is also damaged, bearing gaping wounds or open fractures. As a result, sometimes parts of both legs are lost. Penetrating injuries of the abdomen or chest are also fairly common.

The Russian PFM-1, the so-called butterfly mine, causes a third pattern of injury (Pattern C). This mine earned its nickname because it sports small wings that enable it to glide to the ground after it is released from a helicopter. A huge number of them were dropped during the conflict in Afghanistan. As has often been pointed out, the PFM-1 is particularly fiendish because it is a "toy mine"—a weapon masquerading as a plaything. Specialists insist that the shape of the PFM-1 is dictated by function, but the fact remains that it is attractive to children.

A unique feature of these mines is that they are activated by distortion or cumulative pressure on their wings; in other words, they do not necessarily go off when first touched. In Afghanistan my co-workers and I were told several times that a child had taken the butterfly—or "green parrot," as the Afghans call it—and played with it for hours with friends before any explosion occurred. The

term "toy mine" therefore seems totally justified. In our group's surgical experience of treating more than 150 victims of this type of mine, we have never seen a single injured adult.

Technically, the PFM-1 is just another type of small, scatterable blast mine, but because of the peculiar damage it causes, it deserves a separate description. The PFM-1 is usually being held when it goes off, so it traumatically amputates one or both hands at the wrist. In less severe cases, only two or three fingers are destroyed. Very often the blast does further harm to the chest and the face. Injuries to one or both eyes are very common, producing partial or complete blindness.

Antipersonnel fragmentation mines cause the fourth pattern of injury (Pattern D). Within this group are the "bounding" fragmentation mines, such as the Italian Valmara-69, the U.S.-manufactured M16 series and the Russian OZM series. These weapons are laid on the ground but, when triggered, jump into the air before exploding so that they can disperse their fragments over the maximum range and to the most lethal effect. Directional fragmentation mines—including the U.S.-made M18A1 (or "Claymore") and the Russian MON and POMZ "stake" mines, which aim their projectiles toward a target—are also in this class of weapon. All these mines

are typically operated by trip wires.

The defining feature of fragmentation mines is that they fire metallic shards over a wide area. The Valmara-69, for example, explodes at a height of 50 to 100 centimeters—roughly the level of a man's waist—and projects some 1,000 bits of metallic shrapnel across a 360-degree spread. Mine specialists consider this mine to have a "killing zone" with a 25-meter radius and an "injury zone" of up to 200 meters.

Fragmentation mines produce injuries throughout the body. The size of the wound depends in part on the size of the penetrating splinter. If the victim is meters away from the site of the explosion, the fragments will frequently penetrate the abdomen, the chest or the brain, particularly if a bounding mine is involved. For shorter distances, the injuries resemble those of Pattern B. Still, doctors rarely treat traumatic amputations caused by fragmentation mines because the weapons usually kill in an instant anyone who activates them by direct contact.

In northern Iraq, during the Persian Gulf War, for instance, we observed six casualties from the explosion of a Valmara-69. The two persons who were trying to defuse the mine to recover its aluminum content—worth about \$1 on the local market—were immediately killed. At the same time, four other peo-

COUNTRIES reporting land-mine incidents are shaded on the map at the right. The bar chart shows the number of mines planted in regions only where such estimates are known. The boxes (left) indicate the density of deployed land mines in those regions, measured as the average number of mines per square mile.

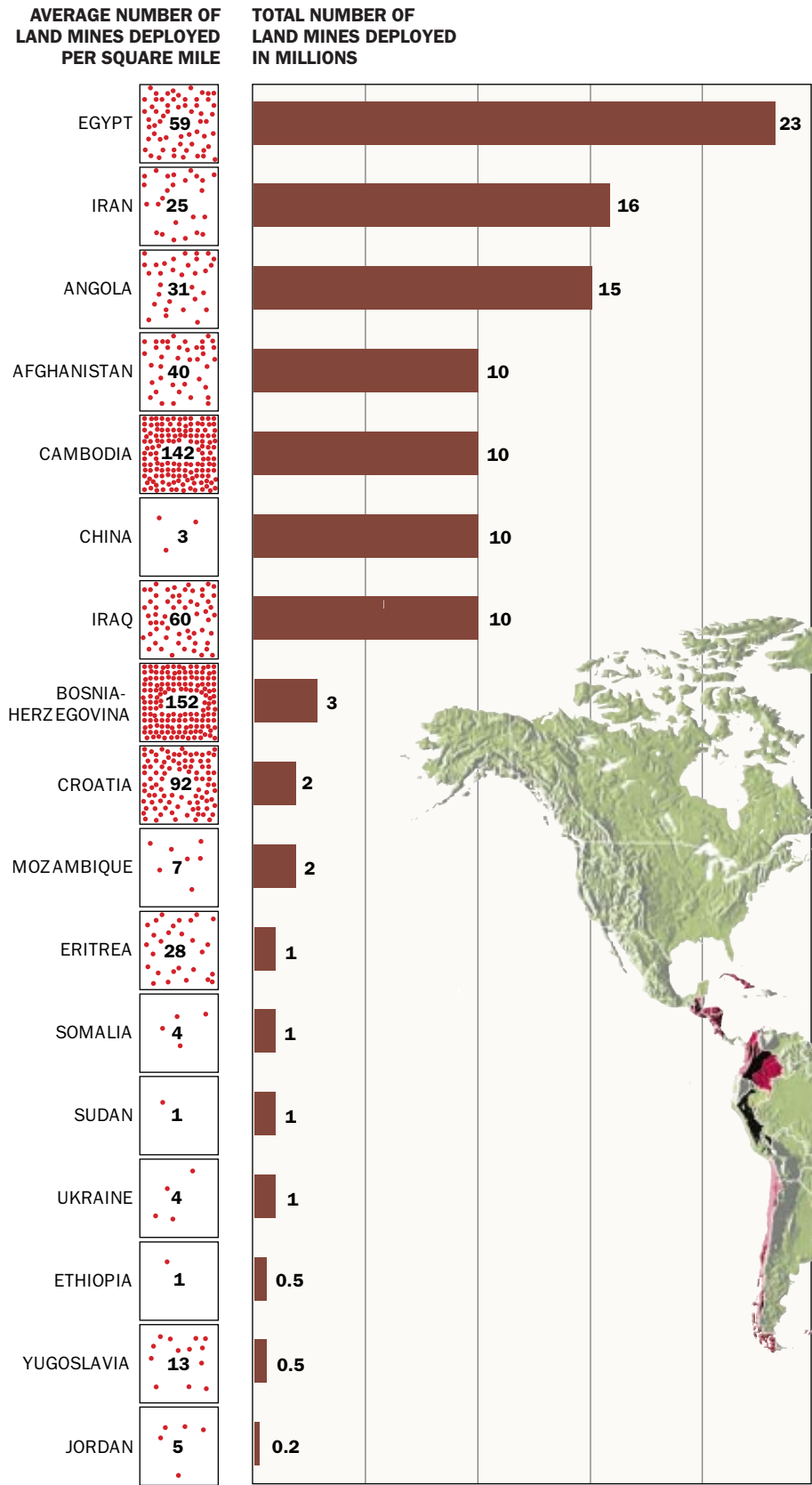
ple nearby, including two young shepherds, were severely injured. Only two of them survived.

The Challenge of Treating Victims

The injury patterns I have described identify the prevalent distribution of wounds that a patient may suffer, but they do not correspond cleanly to levels of severity. A traumatic amputation of the foot with only a small wound in the thigh—a Pattern A casualty—might be life-threatening if the thigh injury involves the femoral artery. Commonly, the patient who sustains a land-mine injury is in critical condition. Often a vital structure is directly damaged, or the wounds (including the traumatic amputations) are so extensive that the patient is imperiled by hemorrhagic shock. In such an emergency situation, identifying a pattern of injury with a specific category of land mine can provide useful information to the surgical team (and also to any personnel involved in clearing the area of mines).

For several reasons, surgery on mine injuries is a complex and challenging discipline. Often the medical team has to work in hazardous areas where the fighting is ongoing. The available facilities are typically primitive. Scarce resources, the lack of proper hygiene, and sometimes even the absence of water and electricity make the job extremely difficult. Furthermore, the surgeons must be trained to deal with all kinds of emergencies: vascular, thoracic, abdominal, orthopedic and so on. Fragments of bone, for example, can become “secondary bullets.” I once had to reconstruct the axillary artery in the shoulder of a patient that had been completely severed by a piece of bone from the patient’s traumatically amputated foot.

From the technical point of view, the keystone operation is the debridement, or surgical cleansing, of the wound. When a blast mine goes off, stones, mud, grass and even pieces of the patient’s clothes or shoes can be pushed deep into the tissues by the ascending explosion. The removal of all foreign



bodies and, even more important, the excision of all dead, dying or weakened tissue from the lesions are of paramount importance in preventing life-threatening postsurgical infections.

A Deadly Legacy

Most patients who recover from land-mine accidents never truly regain their ability to take an active part in family life or society. Rehabilitating these patients under the best circumstances is often immensely problematic. And many victims live in developing countries, where poor living conditions make it even more difficult to overcome physical and psychological handicaps. Moreover, beyond the tremendous human cost that mines claim in lives and suffering, they also impose a severe social and economic burden on entire societies and nations. An army's decision to mine agricultural land has long-term

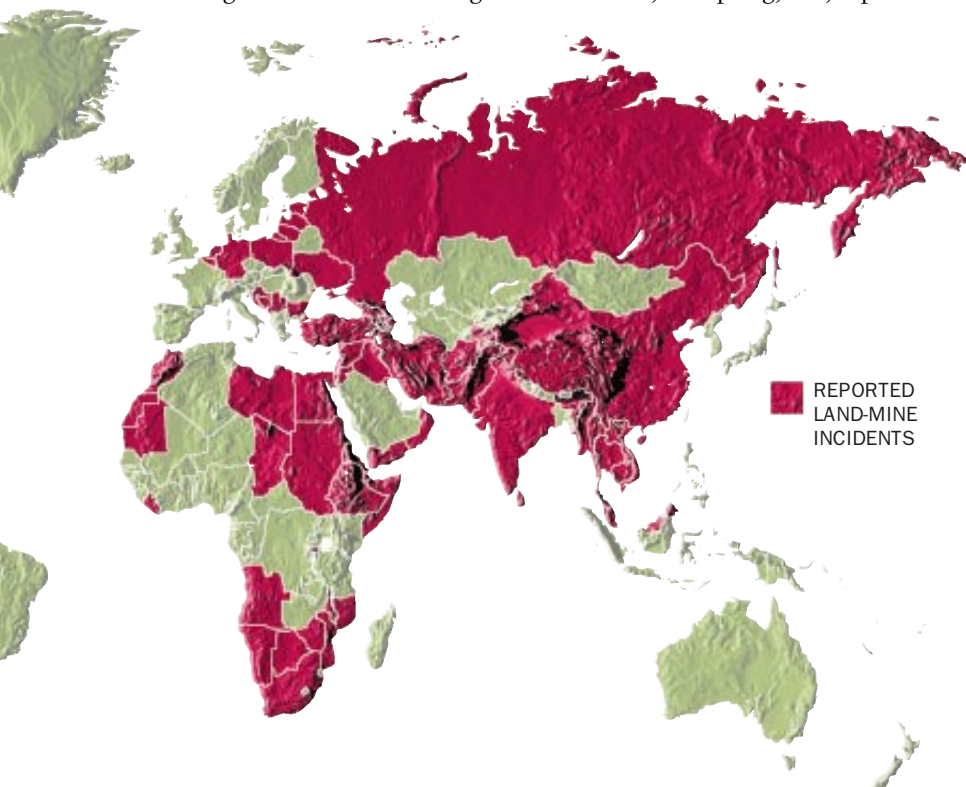
devastating effects on farming communities, who rely on the land for survival. The presence of land mines also deters many wartime refugees from returning to their homes. The displaced people tend to become permanent refugees who overload the economic and social structures of the regions to which they flee.

In 1980 the U.N. adopted what is commonly known as the Convention on Inhumane Weapons. Although this convention and its protocols were supposed to guarantee protection to civilians, events during the rest of that decade demonstrated all too clearly the inadequacy of those regulations. In recent years, more than 400 humanitarian organizations in nearly 30 countries have launched a campaign to raise the international community's awareness of the devastating effects of antipersonnel mines. They have urged the U.N. and national governments to ban the production, stockpiling, sale, export and use

of mines. The campaign has had significant results, and several countries have decided to stop the production or export of land mines, at least temporarily.

In September 1995 a U.N. review conference of the convention gathered in Vienna. International diplomacy focused the discussion on various technical and military aspects of land-mine use. From a humanitarian point of view, the Vienna conference was a fiasco. A total ban on these indiscriminate weapons—the only real solution—was not even taken into consideration. Moreover, it seems unlikely that a ban will be proposed in the session of the conference that is currently under way in Geneva. Certainly most countries and citizens of the world now realize the horrors of nuclear bombs. It is astonishing that those same countries do not object to the daily massacre of innocent civilians by way of antipersonnel mines.

Still, the world in the next century faces a terrible legacy. Many of the mines dropped decades ago may have effective lifetimes of centuries. Indeed, even if no more mines are laid in the future, those that are already in place will cause colossal tragedy and will challenge relief organizations of tomorrow. We may hope that the international community will soon make the issue of land mines a top priority and provide the funds needed to carry on essential humanitarian activities. Emergency surgical assistance and the subsequent rehabilitation of victims, as well as operations to clear mines and to educate people about their dangers, will in fact remain the only options for easing the suffering of hundreds of thousands of people. Even for a veteran war surgeon, looking at the body of a child torn to pieces by these inhumane weapons is startling and upsetting. This carnage has nothing to do with military strategy. It is a deliberate choice to inflict monstrous pain and mutilation. It is a crime against humanity. SA



BORIS STAROSTA

The Author

GINO STRADA received his medical degree from the University of Milan. In 1988 he joined the International Committee of the Red Cross mission in Pakistan and has worked as a war surgeon ever since. He has treated land-mine victims in Afghanistan, Cambodia, Peru, Bosnia, Djibouti, Somalia, Ethiopia, Rwanda and northern Iraq. In 1994 Strada founded EMERGENCY, a humanitarian association serving civilian war victims. For more information, contact EMERGENCY, via Bagutta 12, 20121 Milan, Italy; telephone: 39-2-7600-1104; fax: 39-2-7600-3719.

Further Reading

HIDDEN KILLERS: THE GLOBAL PROBLEM WITH UNCLEARED LANDMINES: A REPORT ON INTERNATIONAL DEMINING. Political-Military Affairs Bureau Office of International Security Operations. U.S. Department of State, 1993. LANDMINES: A DEADLY LEGACY. The Arms Project of Human Rights Watch and Physicians for Human Rights. Human Rights Watch, 1993. SOCIAL CONSEQUENCES OF WIDESPREAD USE OF LANDMINES. Jody Williams in *ICRC Report of the Symposium on Anti-personnel Mines*. ICRC, Geneva, 1993. TEN MILLION TRAGEDIES, ONE STEP AT A TIME. Jim Wurst in *Bulletin of the Atomic Scientists*, Vol. 49, No. 6, pages 14-21; July-August 1993.